6.2 Padilla/Samish Bay

A. Assessment

1. Salmon Use

Chinook

This is part of the Whidbey Basin and Padilla and Samish bays region, which includes independent populations in the Skagit, Stillaquamish, and Snohomish river systems but none from the streams draining directly to this sub-basin.

a) Juvenile

- Juvenile Chinook salmon the Skagit River system historically utilized the three bays in this sub-basin (Padilla, Samish, and Fidalgo) as part of their natal Skagit River delta. Due to alterations in the delta this area is no longer directly accessible to outmigrant Skagit Chinook.
- Juvenile Chinook salmon from the Nooksack populations utilize this sub-basin area for feeding and growth, refuge, physiological transition and as a migratory corridor.
- The area also likely provides significant rearing potential to larger non-natal juvenile Chinook from other sub-basins, perhaps primarily for the northern Puget Sound populations.

b) Adult

- Adult Chinook salmon from non-natal populations (e.g., Nooksack, Skagit) are presumed to utilize this sub-basin. Chinook are documented to use other regions in this sub-basin, including Samish River, Colony Creek, and Indian Slough. It is presumed they also use Edison Slough. See Figure E-1.1 for the distribution.
- It is not known if adult salmon from far outside Puget Sound frequent or utilize this sub-basin

Other Listed Species (not comprehensively reviewed or assessed for this sub-basin)

- Chum salmon: Populations of the Hood Canal/Eastern Strait of Juan de Fuca Summer Chum ESU do not emanate from this sub-basin. Non-natal use may occur, but it is not known for certain. This sub-basin is outside the Hood Canal/Eastern Strait of Juan de Fuca Summer Chum ESU.
- Bull trout (anadromous): Preliminary core populations (from core areas) within the Puget Sound Management Unit of bull trout are not present in this sub-basin. However, the Samish River (and Friday Creek) provides important foraging, migration, and overwintering habitat for sub adult and adult anadromous bull trout (USFWS 2004). Several salmon species and steelhead is a forage base for anadromous bull trout. Samish River habitat is especially important to proximate bull trout populations (e.g., Nooksack, Skagit populations) (USFWS 2004).

2. Ecological and Landscape Conditions

Food Web, Ecological Conditions

Oceanographically, the Padilla/Samish sub-basin is part of the historic Skagit delta where deltaic processes are no longer active. However, the historic flow of fine sediments into Padilla Bay has created a broad, shallow basin making almost the entire bay intertidal. Padilla Bay and Samish Bay both experience reduced mixing since agricultural dikes reduced the freshwater inflow into the area. Samish Bay still has the influence of the Samish River and Edison slough freshwater and sediments. Nutrient implications for the sub-basin include potential eutrophication from agricultural sources. Forage fish (specifically Fidalgo Bay population of herring are important to salmon. Primary/secondary productivity for the system is high because of the extensive eelgrass meadow in Padilla Bay. It is expected that significant amounts of detritus is exported from Padilla Bay to neighboring San Juan Islands and South Georgia Strait sub-basins. The eelgrass also helps to support a thriving Dungeness crab fishery. Padilla Bay is designated as a National Estuarine Research Reserve and contains one of the largest eelgrass beds on the West Coast, providing habitat for many species.

Landscape Conditions

Even though these bays are shallow, significant open water fetch can create waves on the bays and move nearshore sediments along certain key features such as Samish Island and March Point. However, the western margin of this sub-basin contains rocky shorelines that are resistant to longshore drift processes and contain fringing kelp beds. See Figures E-1.1 through 1.3, E-2.4 and 2.5 for depictions of landscape conditions in this sub-basin.

Pocket Estuary Analysis

Our visual analysis of pocket estuaries in this sub-basin revealed seven pocket estuaries: four in Samish Bay and three in Padilla Bay (Figure E-2.4, Appendix E). Among the results were:

- Freshwater sources were observed in all but one of the pocket estuaries,
- Based on the assumptions listed in Appendix B, all three of the Chinook functions (feeding, osmoregulation and refuge) were estimated to occur in six of the seven pocket estuaries.
- Composite "scores" were generated for each pocket estuary based on likely Chinook functions and stressors observed during analyses. Two pocket estuaries were estimated to be *properly functioning*. One pocket estuary was estimated to be *not properly functioning*. The remaining four pocket estuaries were recorded as *at risk*.

Drift Cell Analysis

As in other sub-basins with rocky shorelines, the action of longshore sediment drift processes has reduced importance in shaping the nearshore landscape in this sub-basin. Samish Island is a notable exception. Extensive shallow mudflats that do not appear to move alongshore, but are critical deltaic features of the landscape dominate the eastern shoreline of the sub-basin.

Overall area

- Total area (deep-water plus nearshore) is 52,416 acres (81.9 square miles).
- Deep-water portion (marine waters landscape class) comprises 9,856 acres (15.4 square miles), or 19% of the total sub-basin area.

Nearshore area

- Nearshore portion comprises 42,560 acres (66.5 square miles), or 81% of the total sub-basin area. A natal estuary (landscape class) is not present in this sub-basin (Figure E-1.1).
- Nearshore area within this sub-basin is 10% of the nearshore area of the entire Puget Sound basin.
- Contains 100 miles of shoreline (beaches landscape class).
- The "key" bays (landscape class) identified in this sub-basin are Padilla Bay, Samish Bay, and Fidalgo Bay (Figure E-1.1, Appendix E).
- Ten linear miles (10%) of the shoreline is designated as marine riparian (defined as the estimated area of length overhanging the intertidal zone).
- In this sub-basin, 73% of the shoreline (73 linear miles) has eelgrass (*Zostera marina* and *Z. japonica*); may be patchy or continuous.
- In this sub-basin, 8% of the shoreline (8 linear miles) has floating kelp; may be patchy or continuous. Also in this sub-basin, 17% of the shoreline (17 linear miles) has non-floating kelp; may be patchy or continuous.

The drift cell analysis for this sub-basin is presented in Appendix E, Figure E-2.5 and subsequent text. Recommendations for protection and restoration presented in the Appendix are highlighted in Tables 6-4 and 6-5.

Threats/stressors

Loss and/or simplification of delta and delta wetlands

Comparison of historical wetland area and wetland area reported in Bortleson et al. (1980) revealed that for the Samish delta, the estimated area of subaerial wetlands decreased from 0.73 to 0.15 square miles (decreased by 0.58). The estimated loss or gain of intertidal wetlands is not available. Historically, estuarine wetlands were extensive in the Skagit-Samish delta, consuming an area more than twice that of the Nooksack, Stillaguamish and Snohomish deltas, combined (Collins et al, 2003). Diking and draining of wetlands has reduced the area. The loss of side channel regions and riparian vegetation in floodplains and estuarine areas can be attributed to such activities as agricultural practices (USFWS 2004).

Alteration of flows through major rivers

The isolation of the nearshore habitats of this sub-basin from the flow of the Skagit River system represents a significant historic flow alteration.

Modification of shorelines by armoring, overwater structures and loss of riparian vegetation/LWD

Shoreline armoring occurs along 50.9 miles (51.6%) of the shoreline (Figure E-1.3, Appendix E). Over 47 miles of shoreline are classified as 100% armored. Nearly 38 miles are classified as 0% armored. The total number of overwater structures in this sub-basin is 1,868, consisting of ramps (29), piers and docks (79), small slips (1,726) and large slips (34). These structures are observed in greater concentrations in the northeast section of Fidalgo Island in the area of Anacortes. Within 300 feet of shore, railroads occur along 9.5 miles of shoreline, from near Windy Point in Samish Bay northward to Larrabee State Park, and the northeast section of Fidalgo Island.

Contamination of nearshore and marine resources

Potential contamination sources in Padilla Bay include failing septic systems, stormwater runoff, poor agricultural practices (including dairy farming), and industrial and commercial development.

Two sewage outfalls (Figure E-2.3, Appendix E) and an unknown number of stormwater discharges are also observed in this sub-basin.

Water quality impairments are indicated in Figure E-1.3, Appendix E.

Alteration of biological populations and communities

There are five fish hatcheries on or directly adjacent to this sub-basin with unknown effects on competition and community structure. Refer to the hatchery reform recommendations of the Hatchery Scientific Review Group at the following website.
http://www.lltk.org/pdf/HSRG_Recommendations_March_2003.pdf

Transformation of land cover and hydrologic function of small marine discharges via urbanization

Rural development and suburban sprawl is an increasing threat within the agricultural region of Padilla Bay (citation in Estuarine Research Federation Spring 2003 Newsletter). Fidalgo Bay and Edison Slough are among the pocket estuaries degraded by urbanization within this sub-basin (Figure E-2.4, Appendix E). See Figure E-2.4 for an evaluation of pocket estuaries and stressors noted through review of oblique aerial photos. Figure E-1.2, Appendix E, presents land cover information for the area surrounding this sub-basin.

Transformation of habitat types and features via colonization by invasive plants

In this sub-basin, 5% of the shoreline (5 miles) contains patchy or continuous *Spartina spp*. Also, 18% of the shoreline (18 miles) contains patchy or continuous *Sargassum muticum*. *Spartina alterniflora* has nearly been eradicated from Padilla Bay, but seedlings from *S. anglica* are present in adjacent bays and require annual monitoring and control (citation from Estuarine Research Federation Spring 2003 Newsletter).

B. Evaluation

In this section we list goals and evaluate the level of realized function for natal and non-natal Chinook, summer chum, and bull trout. From this we then list each of the proposed protection and restoration actions for this sub-basin, and describe the benefits to natal Chinook, non-natal Chinook, and summer chum and bull trout (if any).

Goals for listed salmon and bull trout

a) Provide support for all neighboring Puget Sound populations, particularly the Skagit River and Nooksack River Chinook salmon populations
b) Provide foraging, migration and overwintering habitats for neighboring populations of bull trout.
c) Support spatial structure & diversity VSP parameters for all salmon populations
d) Provide early marine support for independent spawning aggregations occurring in this sub-basin.

Realized function for listed salmon and bull trout

Fry migrant Chinook – Fry migrants from both the Nooksack and Skagit estuaries are likely to use this entire sub-basin, not just the pocket estuaries, as the shallow water, mudflats and eelgrass beds support similar functions as pocket estuaries (Figure E-1.2, Appendix E). The existing unarmored shorelines and three fully functioning pocket estuaries support this life history type very well. During high tides and storm events, however, all seven pocket estuaries may be needed to support refuge functions. Chemical stressors and sewage outfalls likely affect Nooksack fry migrants as they move into Samish Bay. Water quality impacts from agricultural runoff can affect this life history type throughout the sub-basin. Connectivity between Padilla Bay and the Skagit estuaries is limited for fry migrants from the Skagit and other river systems in Whidbey Basin. Spartina infestations could impact this life history type by blocking channels with sediment. Any oil spills from March Point are a threat to this life history type. Because of the loss of historic connection of this sub-basin to the Skagit delta, there is a loss of opportunity and capacity from Skagit populations. Moreover, degradation of Fidalgo Bay results in a loss of capacity for this life history type.

Delta fry Chinook – No delta fry life history types are expected to be present in this sub-basin unless extreme flood events transport delta fry from the Nooksack estuary to the north or the Skagit estuary to the south. In such an event, the extensive mudflat and eelgrass habitats within this sub-basin would support delta fry. Significant improvement to this function could be realized by removal of dikes fronting both Samish and Padilla bays eastern shorelines. Spartina infestation will likely have little adverse impact to this life history type unless infestations begin to block existing channels. Any oil spills from March Point are a threat to this life history type. Because of the loss of historic connection of this sub-basin to the Skagit delta, there is a loss of opportunity and capacity from Skagit populations. Moreover, degradation of Fidalgo Bay results in a loss of capacity for this life history type.

Parr migrant Chinook – A diversity of habitat types exist for parr migrants in this sub-basin. Opportunity to access them for populations from the Whidbey sub-basin is constrained as mentioned above for fry migrants. Spartina infestations could affect parr migrants seeking nearshore channel structure in salt marshes. Oil spills from March Point could pose a threat to this life history type if they are present at the time of the spill. Loss and degradation of small estuaries and shallow water areas has reduced the availability of prey and refuge as well as disrupted migration for this life history type. Because of the loss of historic connection of this sub-basin to the Skagit delta, there is a loss of opportunity and capacity from Skagit populations. Moreover, degradation of Fidalgo Bay results in a loss of capacity for this life history type.

Yearling Chinook - Any reduction in capacity as a result of non-support of the three smaller life history types within this sub-basin will negatively affect yearling migrants. It is expected that parr migrating from other sub-basins to the south and north will be a significant source of food for yearling migrants. Yearlings will also require access to forage fish resources within the sub-basin, which are considerable. Any smaller life history types affected by an oil spill from March Point will also affect this life history type through lower prey availability or threat of toxic contamination of the food chain. Loss and degradation of small estuaries and shallow water areas has reduced the availability of prey and refuge as well as disrupted migration for this life history type. Because of the loss of historic connection of this sub-basin to the Skagit delta, there is a loss of opportunity and capacity from Skagit populations. Moreover, degradation of Fidalgo Bay results in a loss of capacity for this life history type.

Sub-adult and adult Chinook – Survival of sub-adult and adult Chinook salmon is dependent on several factors, including the production and availability of forage fish species within nearshore regions, marine vegetation such as eelgrass and kelp, and water quality. We hypothesize that during even-numbered years, Chinook salmon may experience increased competition with pink salmon for resources.

Listed summer chum – We hypothesize that Hood Canal/Eastern Strait of Juan de Fuca summer chum do not use this sub-basin.

Anadromous bull trout – Even though this sub-basin does not contain core area populations, sub-adult and adult anadromous bull trout from nearby populations utilize regions of this sub-basin as foraging, migration and overwintering habitats.

Table 6-4. Recommended protection actions for Padilla/Samish Bay

Protection Action	Benefit to Natal Chinook	Benefit to other (non-natal) Chinook	Benefit to summer chum, bull trout, other fish
Aggressively protect unarmored shorelines, especially along the west shore of Padilla Bay and all shorelines of Guemes Island	Protects features which may support rearing of fish from independent spawning aggregations	Protects shallow subtidal shelves supporting vegetated migration corridors for Nooksack and Skagit migrants	
Protect Fidalgo Bay herring	N/A	Protects feeding function	Protects feeding function

stock (support both staging and spawning functions in this area)		for all populations migrating through this sub-basin	for anadromous bull trout
Continue protections of large eelgrass meadow (2nd largest on the west coast) in Padilla Bay.	Protects features which may support rearing of fish from independent spawning aggregations	Vegetative cover for migration, feeding of Skagit and Nooksack parr migrants, yearlings	Protects feeding function for anadromous bull trout
Protect against further *Spartina* infestations.	Protects features which may support rearing of fish from independent spawning aggregations	Protects existing physiological transition, feeding and refuge functions for Skagit and Nooksack, other migrating populations	
Aggressively protect Joe Leary Slough, Indian Slough and Samish River delta estuaries	Protects features which may support rearing of fish from independent spawning aggregations	Protects existing physiological transition, feeding and refuge functions for Skagit and Nooksack, other migrating populations	Protects feeding function for anadromous bull trout

Table 6-5. Recommended improvement actions for Padilla/Samish Bay

Improvement Action	**Benefit to Natal Chinook**	**Benefit to Other (non-natal) Chinook**	**Benefit to summer chum, bull trout, other fish**
Continue to mechanically remove *Spartina* colonies	May improve rearing of fish from independent spawning aggregations	Increase native cover and feeding support for Nooksack and Skagit migrants	
Improve connections between the Skagit delta and Padilla Bay to support two-way movement of fish	May improve rearing of fish from independent spawning aggregations	Support feeding and refuge functions of the Skagit such as fry and parr outmigrants, particularly of the delta fry life history type.	Would improve access/connectivity between the Skagit delta and neighboring deltas for bull trout feeding
Remove agricultural dikes along the south shoreline of Padilla and Samish Bays where feasible	May improve rearing of fish from independent spawning aggregations	Support feeding and refuge functions of the Skagit such as fry and parr outmigrants, particularly of the delta fry life history type.	Would improve access/connectivity between the Skagit delta and neighboring deltas for bull trout feeding
Consider wastewater reclamation and reuse retrofits for Anacortes wastewater discharge	May improve rearing of fish from independent spawning aggregations	Reduced physiological stress from nutrient loading and potential eutrophication	Reduced physiological stress from nutrient loading and potential eutrophication